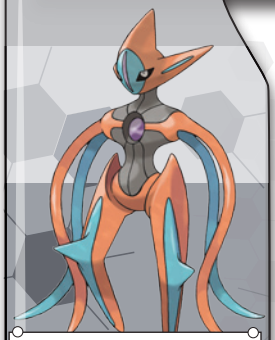
What is the ozone layer?



LEARN the real **science** behind DEOXYS

Pokémon TRADING CARD GAME

DEOXYS is a new Pokémon character in the Trading Card Game, and there is real world science behind its story.

For more real science visit:
http://ksnn.larc.nasa.gov/pokemon

PURPOSE

To investigate the effects of solar radiation on an object

BACKGROUND

The Sun's radiation is very powerful and can be dangerous to human beings. In space, astronauts are exposed to more ultraviolet (UV) radiation than they are here on Earth and must be particularly careful to protect themselves by wearing helmets with face shields. On Earth, we have the ozone layer and lower atmosphere to help absorb and/or scatter some of the harmful UV rays of the Sun; however, there is still enough radiation to harm us.

Have you ever been sunburned? Exposing your skin to too much solar radiation causes sunburn. People protect their skin from harmful solar UV radiation by using sunscreen. Sunscreen blocks or absorbs some of the UV light. Sunscreens offer various levels of protections and have a Sun Protection Factor (SPF), a number on the sunscreen. This number, multiplied by 10, gives you the number of minutes you can be exposed to the Sun without getting burned. For example, an SPF of 10 provides you with 100 minutes of protection from the Sun's harmful rays. Recent studies have shown that there is little difference between the protection power of SPF 30 and any of the higher SPFs.

Less ozone would result in more solar radiation. Without the protection of the ozone layer, you would need much more than sunscreen to protect you from damaging UV rays.

Many thanks to the NASA SCI FilesTM for this activity. Visit http://scifiles.larc.nasa.gov and learn more about solar radiation and other challenges for crewed missions.

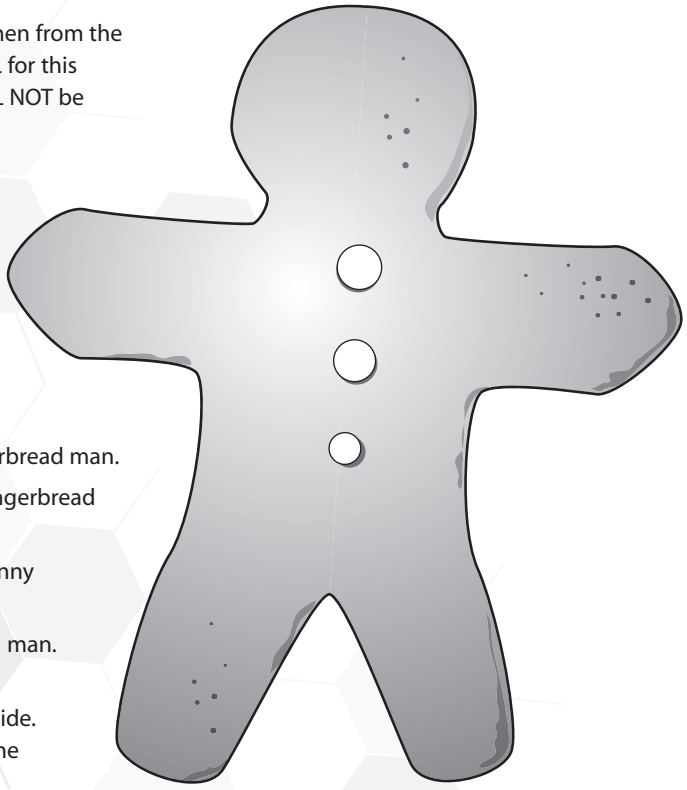
MATERIALS

For each group:

- dark construction paper *(blue, purple, or red are best)*
- scissors
- permanent marker
- sunscreen of 5 different SPFs *(same brand)*
- gingerbread man template

PROCEDURE

1. Use the template to cut two large gingerbread men from the dark construction paper. One will be a CONTROL for this activity. Put the control someplace where it WILL NOT be in the sun.
2. Using the permanent marker, divide the other gingerbread man into sections: head, arms, and legs.
3. Label each section with a different SPF number.
4. Coat the sections with the corresponding SPF sunscreen. Note: To control as many variables as possible, use the same brand of sunscreen for all samples.
5. Do not put sunscreen in the middle of the gingerbread man.
6. Predict what will happen when you place the gingerbread man outside in the sunlight.
7. Place your gingerbread man outside in a very sunny location.
8. Every 30–60 minutes, check on your gingerbread man. Record your observations.
9. After a few hours, bring the gingerbread man inside. Compare the one that's been in the sun to the one you protected.



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CONCLUSION

1. How does the CONTROL compare to the gingerbread man that was outside?
2. What happened to the unprotected part of the gingerbread man?
3. Which SPF gave the most protection? How can you tell?
4. What conditions may change the amount of sunscreen needed?
5. If the "hole in the ozone layer" were to spread, how might your results be affected?

EXTENSIONS

1. UV beads are available from some science supply companies. They change from white to various colors when exposed to UV light. Try some of these extensions with UV beads.

   a. Tie a UV bead to a string and take it, along with a ruler and a pail of water outside. Lower the bead 2 centimeters (cm) into water and watch for a color change. Repeat by lowering the bead 2 more cm each time until no color change is observed. How far down does the sunlight penetrate water?

   b. Take a pair of sunglasses and place them in front of the UV bead, shading the bead from the sunlight. Do the sunglasses protect the bead from UV light?

   c. Observe UV beads indoors. What happens when the beads are indoors? Place the beads in a windowsill. Does UV light penetrate glass?

   d. Take the beads outside on a cloudy day. Is there UV light on a cloudy day?

   e. Create other experiments with the UV beads.